Claims List:

Claims 1-68 (Cancelled)

69. A system for assaying hematopoiesis and hematotoxicity in a cell by luminescence output comprising:
    a. a target cell population of mononuclear cells;
    b. a serum mix;
    c. a methyl-cellulose mix,
    d. a growth factor mix or a cytokine specific for a single sub-population within the target cell population of mononuclear cells;
    e. a medium;
    f. an ATP-releasing reagent;
    g. an ATP luminescence-monitoring reagent; and
    h. a plate wherein the target cell population, serum mix, methyl-cellulose mix, the growth factor mix or the cytokine, the medium, the ATP-releasing reagent, and the ATP luminescence-monitoring reagent are combined in an order to determine the proliferative state of the single subpopulation by luminescence output thereof.
70. The system of Claim 69, wherein the growth factor mix or the cytokine including at least one growth factor or cytokine selected from the group of erythropoietin, granulocyte-macrophage colony stimulating factor, granulocyte colony stimulating factor, macrophage colony stimulating factor, thrombopoietin, stem cell factor, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-7, interleukin-15, Flt3L, and leukemia inhibitory factor, and combinations thereof.
71. The system of Claim 70, further comprising instructions for determining the proliferative state or the hematotoxicity of the single subpopulation by luminescence output.
72. The system of Claim 71, wherein the target cell population of mononuclear cells comprises a population of human or animal hematopoietic cells.
73. The system of Claim 71, further comprising an ATP standard solution.
74. The system of Claim 72, wherein the serum mix comprises bovine serum albumin, an insulin, an iron-saturated transferrin, a serum and IMDM.
75. The system of Claim 73, wherein the insulin is recombinant insulin.

76. The system of Claim 74, wherein the methyl cellulose mix has between about 1.5% and about 2.5% methyl cellulose.

77. The system of Claim 76, where the medium comprises fetal bovine serum having a concentration of between 0% to about 30% by volume;

    a. the methyl cellulose having a concentration of between about 0.4% to about 0.7%, by weight and in an atmosphere comprising between about 3.5% oxygen and about 7.5% oxygen; and

    b. instructions for determining the luminescence generated by the reagent contacting the cell population, wherein the level of luminescence correlates to the amount of ATP in the cell population, wherein the amount of ATP correlates to the proliferative status of the target cell population.

78. The system of Claim 77, wherein the concentration of fetal bovine serum in the cell growth medium is between about 0% to about 10% by volume.

79. The system of Claim 77, wherein the concentration of methyl cellulose in the cell growth medium is about 0.7% by weight.

80. The system of Claim 77, wherein the concentration of oxygen in the atmosphere is about 5% by volume.

81. The system of Claim 77, wherein the target cell population includes an enriched population of hematopoietic stem cells.

82. The system of Claim 77, further comprising a cell suspension enriched in at least one hematopoietic progenitor cell lineage.

83. The system of Claim 77, wherein the target cell population comprises hematopoietic stem cells.

84. The system of Claim 77, wherein the target cell population comprises hematopoietic progenitor cells.

85. The system of Claim 77, wherein the target cell population comprises hematopoietic stem cells and hematopoietic progenitor cells.

86. The system of Claim 77, wherein the target cell population are primary hematopoietic cells.

87. The system of Claim 86, wherein the primary hematopoietic cells are isolated from an animal tissue selected from the group consisting of peripheral blood, bone marrow, umbilical cord blood, yolk sac, fetal liver, and spleen.
88. The system of Claim 87, wherein the animal tissue is obtained from a human.
89. The system of Claim 88, wherein the animal tissue is obtained from a mammal.
90. The system of Claim 89, wherein the mammal is selected from the group consisting of cow, sheep, pig, horse, goat, dog, cat, non-human primates, rodents, rabbit and hare.
91. The system of Claim 89, wherein the animal tissue is selected from bone marrow, yolk sac, fetal liver, and spleen.
92. The system of Claim 88, wherein the human tissue is further selected from the group consisting of peripheral blood, bone marrow, and umbilical cord blood.
93. The system of Claim 86, wherein the primary hematopoietic stem cells are isolated from peripheral blood.

94. **The system of Claim 77**, wherein the target cell population further comprises a differentially distinguishable subpopulation of primitive hematopoietic cells, wherein the subpopulation of cells is defined by a cell surface marker thereon.
95. The system of Claim 94, wherein the differentially distinguishable subpopulation of target cells comprises:
    a. a cell surface marker indicator capable of selectively binding to a cell surface marker of a differentially distinguishable subpopulation of cells; and
    b. instructions for selectively isolating the subpopulation of cells binding the indicator.
96. The system of Claim 94, wherein the cell surface marker is selected from the group consisting of CD3, CD4, CD8, CD34, CD90 (Thy-1) antigen, CD117, CD38, CD56, CD61, CD41, glycophorin A, HLA-DR, and CD133.
97. The system of Claim 94, wherein the cell surface marker is $CD34^{+}$.
98. The system of Claim 95, wherein a magnetic bead separation selectively isolates the subpopulation of differentially distinguishable primitive cells.

99. The system of Claim 95, wherein a flow cytometry and cell sorting apparatus selectively isolates the differentially distinguishable subpopulation of primitive hematopoietic cells.

100. **The system of Claim 77**, wherein the single subpopulation comprises a stem cell lineage selected from the group consisting of colony-forming cell-blast (CFC-blast), high proliferative potential colony forming cell (HPP-CFC) colony-forming unit-granulocyte, erythroid, macrophage, megakaryocyte (CFU-GEMM).

101. The system of Claim 77, wherein the single subpopulation comprises a hematopoietic progenitor cell lineage selected from the group consisting of granulocyte-macrophage colony-forming cell (GM-CFC), megakaryocyte colony-forming cell (Mk-CFC), macrophage colony-forming cell (M-CFC), granulocyte colony forming cell (G-CFC), burst-forming unit erythroid (BFU-E), colony-forming unit-erythroid (CFU-E), colony-forming cell-basophil (CFC-Bas), colony-forming cell-eosinophil (CFC-Eo), B cell colony-forming cell (B-CFC) and T cell colony-forming cell (T-CFC).

102. The system of Claim 77, wherein the reagent capable of generating luminescence in the presence of ATP comprises luciferin and luciferase.

103. **The system of Claim 77**, wherein the at least one cytokine is selected from the group consisting of erythropoietin, granulocyte-macrophage colony stimulating factor, granulocyte colony stimulating factor, macrophage colony stimulating factor, thrombopoietin, stem cell factor, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-7, interleukin-15, Flt3L, leukemia inhibitory factor, and combinations thereof.

104. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of stem cell factor, interleukin-6 and Flt3L.

105. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of macrophage colony stimulating factor, interleukin-1, interleukin-3, interleukin-6 and stem cell factor.

106. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of erythropoietin, granulocyte-macrophage colony stimulating factor,

granulocyte colony stimulating factor, stem cell factor, interleukin-3, interleukin-6, and Flt3L.

107. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of erythropoietin, erythropoietin and interleukin-3, erythropoietin and stem cell factor and erythropoietin, stem cell factor and interleukin-3.

108. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of granulocyte-macrophage colony stimulating factor, granulocyte-macrophage colony stimulating factor and interleukin-3, and granulocyte-macrophage colony stimulating factor, interleukin-3 and stem cell factor.

109. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of the groups consisting of thrombopoietin, and thrombopoietin, interleukin-3 and interleukin-6.

110. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of interleukin-2, and interleukin-7, Flt3L and interleukin-15.

111. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of interleukin-7, and interleukin-7 and Flt3L.

112. The system of Claim 77, wherein the at least one cytokine is erythropoietin.

113. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of granulocyte-colony stimulating factor and granulocyte-macrophage colony stimulating factor.

114. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of interleukin-3, and interleukin-3 and stem cell factor.

115. The system of Claim 77, wherein the cytokine is granulocyte-macrophage colony stimulating factor, interleukin-3 and interleukin-5.

116. The system of Claim 77, wherein the at least one cytokine is selected from the group consisting of macrophage colony stimulating factor, macrophage colony stimulating factor and granulocyte-macrophage colony stimulating factor, and granulocyte-macrophage colony stimulating factor.

117. **The system of Claim 76**, further comprising

a. a test compound contacting the target cell population; and

b. instructions to determine the ability of the test compound to modulate the proliferation, and optionally differentiation, of the target cell population.

118. The system of Claim 76, further comprising instructions to determine the ability of the test compound to modulate the differentiation, of the target cell population.

119. The system of Claim 77, wherein the target cell population comprises a plurality of target cell populations, and

a. a compound contacting the plurality of target cell populations; and

b. instructions to determine the ability of the a test compound to alter the proliferation of the target cell population by comparing the proliferative status of the plurality of target cell populations with the proliferative status of a target population of primitive hematopoietic cells not in contact with the test compound; and

c. instructions to identify the at least one test compound modulating the proliferative status of the target cell population.

120. The system of Claim 77, further comprising a high-throughput assay apparatus for rapidly identifying a compound capable of modulating the proliferative status of a target cell population, comprising:

a. a target cell population divided into a first target cell population and a second target cell population;

b. an incubator, the first target cell population, a cell growth medium comprising a concentration of fetal bovine serum between about 0% to about 30% by weight, and methyl cellulose between about 0.4% to about 0.7% by weight, and in an atmosphere having between about 3.5% oxygen to about 7.5% oxygen by volume, in combination;

c. the second target cell population comprising primitive hematopoietic cells;

d. at least one cytokine contacting the first and second target cell population, wherein the at least one cytokine is selected from the group consisting of erythropoietin, granulocyte-macrophage colony stimulating factor, granulocyte colony stimulating factor, macrophage colony stimulating factor, thrombopoietin, stem cell factor, interleukin-1, interleukin-2, interleukin-3, interleukin-6,

interleukin-7, interleukin-15, Flt3L, leukemia inhibitory factor, insulin-like growth factor, and insulin;

e. at least one test compound contacting the first target cell populations;

f. the ATP-releasing reagent and the ATP luminescence-monitoring reagent contacting the first and second target cell populations;

g. the ATP luminescence-monitoring reagent detecting the level of luminescence generated by, wherein the level of luminescence indicating the proliferative status of the first and second target cell populations; and

h. instructions for comparing the proliferative status of the first target cell population with the proliferative status of the second target population of primitive hematopoietic cells, to identify a test compound capable of modulating the proliferative status of a target cell population.

121. The system of Claim 120, wherein the at least one cytokine contacting the first and second target cell populations generates target cell populations enriched in hematopoietic stem cells.

122. The system of Claim 121, wherein the hematopoietic stem cells are selected from the group consisting of colony-forming cell-blast (CFC-blast), high proliferative potential colony forming cell (HPP-CFC) colony-forming unit-granulocyte, erythroid, macrophage, megakaryocyte (CFU-GEMM).

123. The system of Claim 120, wherein the at least one cytokine contacting the first and second target cell populations generates target cell populations enriched in at least one hematopoietic progenitor cell lineage.

124. The system of Claim 123, wherein the hematopoietic progenitor cell lineage is selected from the group consisting of granulocyte-macrophage colony-forming cell (GM-CFC), megakaryocyte colony-forming cell (Mk-CFC), macrophage colony-forming cell (M-CFC), granulocyte colony forming cell (G-CFC), burst-forming unit erythroid (BFU-E), colony-forming unit-erythroid (CFU-E), colony-forming cell-basophil (CFC-Bas), colony-forming cell-eosinophil (CFC-Eo), B cell colony-forming cell (B-CFC) and T cell colony-forming cell (T-CFC).

125. The system of Claim 120, wherein the method further comprises: contacting the first target cell population with at least two concentrations of a test compound; and calculating the IC50 of the test compound.

126. The system of Claim 120, wherein the method further comprises calculating the IC90 of the test compound.

127. **An assay for testing hematopoiesis and hematotoxicity by luminescence output using the system of Claim 69 comprising the steps of**:

a. forming a master mix comprising a serum mix, a methyl cellulose mix, a growth factor mix or a cytokine and the target cell population;
b. distributing the master mix into the wells of a luminescent plate;
c. incubating the distributed master mix;
d. determining the intracellular ATP content of the target cell population of the incubated master mix by determining relative luminescent units; and
e. correlating said relative luminescent units with the proliferative state of the target cell population.

128. The assay according to claim 127, further comprising

a. incubating the target cell population in a cell growth medium comprising fetal bovine serum having a concentration of between 0% to about 30% by volume and methyl cellulose having a concentration of between about 0.4% to about 0.7%, by weight and in an atmosphere comprising between about 3.5% oxygen and about 7.5% oxygen;
b. contacting the target cell population with the ATP-releasing reagent and the ATP luminescence-monitoring reagent; and
c. determining the luminescence generated by the reagent contacting the cell population, wherein the level of luminescence correlates to the amount of ATP in the cell population, wherein the amount of ATP correlates to the proliferative status of the target cell population.

129. The assay of Claim 128, further comprising contacting the target cell population with at least one cytokine.

130. The assay of Claim 129, further comprising generating a target cell population enriched in hematopoietic stem cells.

131. The assay of Claim 130, further comprising selecting a differentially distinguishable subpopulation of primitive hematopoietic cells from the target cell population, wherein the subpopulation of cells is defined by a cell surface marker thereon.

132. The assay of Claim 129, wherein the target cell population comprises a hematopoietic progenitor cell lineage selected from the group consisting of granulocyte-macrophage colony-forming cell (GM-CFC), megakaryocyte colony-forming cell (Mk-CFC), macrophage colony-forming cell (M-CFC), granulocyte colony forming cell (G-CFC), burst-forming unit erythroid (BFU-E), colony-forming unit-erythroid (CFU-E), colony-forming cell-basophil (CFC-Bas), colony-forming cell-eosinophil (CFC-Eo), B cell colony-forming cell (B-CFC) and T cell colony-forming cell (T-CFC).

133. The assay of Claim 129, wherein at least one cytokine is selected from the group consisting of erythropoietin, granulocyte-macrophage colony stimulating factor, granulocyte colony stimulating factor, macrophage colony stimulating factor, thrombopoietin, stem cell factor, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-7, interleukin-15, Flt3L, leukemia inhibitory factor, and combinations thereof.

134. The assay of Claim 127, further comprising identifying a population of primitive hematopoietic cells having a proliferative status suitable for transplantation into a recipient patient.

135. The assay of Claim 127, further comprising contacting the target cell population with a test compound; and determining the ability of the test compound to modulate the proliferation, and optionally differentiation, of the target cell population.

136. The assay of Claim 127, wherein the method is a high-throughput assay method for rapidly identifying a compound capable of modulating the proliferative status of a target cell population, comprising:

    a. obtaining a target cell population;

    b. dividing the target cell population into a first target cell population and a second target cell population;

c. incubating the first target cell population in a cell growth medium comprising a concentration of fetal bovine serum between about 0% to about 30% by weight and methyl cellulose between about 0.4% to about 0.7% by weight, and in an atmosphere having between about 3.5% oxygen to about 7.5% oxygen by volume; providing a second target cell population comprising primitive hematopoietic cells;

d. contacting the first and second target cell population with at least one cytokine selected from the group consisting of erythropoietin, granulocyte-macrophage colony stimulating factor, granulocyte colony stimulating factor, macrophage colony stimulating factor, thrombopoietin, stem cell factor, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-7, interleukin-15, Flt3L, leukemia inhibitory factor, insulin-like growth factor, and insulin;

e. contacting the first target cell populations with at least one test compound; contacting the first and second target cell populations with the ATP-releasing reagent and the ATP luminescence-monitoring reagent;

f. detecting the level of luminescence generated by the ATP luminescence-monitoring reagent, the level of luminescence indicating the proliferative status of the first and second target cell populations; and

g. comparing the proliferative status of the first target cell population with the proliferative status of the second target population of primitive hematopoietic cells, thereby identifying a test compound capable of modulating the proliferative status of a target cell population.